Improving Vaccination Rates in Adults

by

Troy D. B. Lyons

BS, Biology, University of Pittsburgh, 1992

MD, Temple University, 1997

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This essay is submitted

by

Troy D. B. Lyons

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and approved by

Essay Advisor: Gerald M. Barron, MPH, Associate Professor, Department of Health Policy and Management, Graduate School of Public Health, University of Pittsburgh

Essay Reader: Danforth N. Lincoln, MD, Assistant Professor, Department of Family Medicine, University of Pittsburgh

Gerald M. Barron, MPH

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Troy D. B. Lyons, MPH

University of Pittsburgh, 2020

Abstract

Vaccination is arguably one of the greatest accomplishments to the improvement of public health and longevity in this lifetime. It is estimated that vaccinations prevent 2.5 million deaths per year and have significantly contributed to a greater than 30-year increase in lifespan from the 1900s through today. Vaccination has notably decreased both morbidity and mortality. Thus, it has improved the quality of life and reduced the economic burden for the population. Although riddled with its controversies and barriers, it remains a mainstay to preventative health. Children are routinely vaccinated, but it was not until 2005 that adult vaccination began to grow in popularity. Being an unfamiliar notion to most adults, this crusade met opposition (education/misinformation barriers, financial barriers and access). As a result, several interventions have been proposed to increase vaccination efforts for the adult population. This paper strives to briefly review vaccination and its relevance in the adult population and to discuss the outcome of a process improvement goal by Premier Medical Associates to increase vaccination rates for pneumococcus and influenza in its adult population. Premier successfully increased its pneumococcal vaccination rates from a baseline of 66% to 78% and influenza's vaccination rate from 40% to 80% in a one-year period. Despite its tremendous successes there were still significant barriers that hindered even larger improvements. This paper discusses Premier's process, successes; also discusses the barriers and suggestions to overcome them.

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Preface

I am grateful to my essay advisor Professor Barron and my reader Dr. Danforth Lincoln who guided me throughout the process and were thorough with their feedback. I greatly appreciate their time and investment in my process.

1.0 Public Health Relevance

Population health is an approach aimed at targeting an entire population in order to affect the overall health of the general group as opposed to an individual. It is a common approach in Public Health policies such as Tobacco 21, The Clean Air Act or Lead prevention. Following that theme, this vaccine initiative carries similar intentions to affect the overall health of a population. However, it serves to apply a series of changes to how individual patients engage with healthcare with a goal to impact a large subset of the community (Premier Medical Associates' adult patient population) to improve the overall health of that population. Physicians are in a unique position and often have personal relationships with patients. They have an extreme degree of influence on how information is presented. This project intersects individualized traditional health care via the doctor-patient relationship with attempting to move an entire group of patients towards overall health. While a great deal of public health successes hinge upon policy implementation, this newer approach is one that is starting to gain strong interest in medical arenas. Insurance companies see value in their members being healthier; thus, utilizing less health care and driving down costs. They are therefore rewarding providers with revenue savings when they yield healthier populations. Looking at the bigger picture, cost savings and a healthier population would intuitively lead to lower healthcare costs and hopefully impact the percentage of the gross domestic product spent on healthcare.

2.0 Introduction

Similar to clean water and the development of penicillin, vaccination is one of the most important public health advancements of the eighteenth century. Vaccinations have saved numerous lives and have sustained the quality of lives of many by reducing the morbidity associated with surviving many of these preventable diseases. Vaccination provides active immunity. It creates immunity by allowing the body to develop protection against an infection by exposure to a portion of a particle that causes the infection; thus allowing the human body the ability to make antibodies to protect itself from a true encounter with the actual organism. (Riedel, 2005) It does this with relatively low risk. Serious reactions are rare. Adults who receive influenza vaccine, for example, can experience minor reactions such as localized site pain (28%), headache (16%) and malaise (10%). (Centers for Disease Control and Prevention, n.d.) Despite the health benefits of vaccination, there are many reasons that individuals choose not to be vaccinated. Among the reasons are access, cost, incomplete information, and personal choice; leaving them vulnerable to many preventable infections. Currently twenty-six vaccines are licensed for use. The vaccines relevant to this paper are Pneumococcal and Influenza. Both vaccines prevent illnesses that can result in significant morbidity and mortality, ravaging the lives of many. In the US, pneumococcus is responsible for 7 million cases of otitis media, 500,000 cases of pneumonia, 50,000 cases of sepsis, 3,000 cases of meningitis and 40,000 deaths. (Merck Manual, 2019) Influenza is no less imposing. It is estimated that it poses an economic burden of over $87 billion dollars a year and can result in significant morbidity and/or mortality. Lost earnings of $16.3 billion dollars occur annually as a result of the influenza virus (Puturi, Muscatello, Stockwell, & Newall, 2018)

3.0 Background

3.1 What Is Vaccination?

The notion that one might develop active immunity against an illness after contracting it was noted in 430 BC by the Thucydides. Similarly, populations in China attempted to cause artificial active immunity via dangerous rituals of exposure to dried smallpox pustules to develop protections from this deadly illness. (Rappuoli, Pizza, & DeGregorio, 2014) Later, a revolutionary idea was first introduced by Edward Jenner in 1796 after an observation that milkmaids who had previously contracted cowpox were later immune to developing smallpox. The revelation that an illness could later protect against another encounter with that illness was the beginning of understanding how to manipulate the immune system in such a way that has ultimately led to extending the lifespan of generations, growing the world's population, and protecting vulnerable individuals who might otherwise succumb to these infections. Vaccination is essentially providing the body's immune system with a memory of what a certain bacteria or virus may "look like" in order to be prepared to fight off infection. It is the equivalent of having a "wanted poster" in the body to warn and prepare for illness. The human immune system protects the body through a complicated interaction of cells communicating with one another. To simplify the process, white blood cells protect the body from invading infection. White blood cells come in three varieties: Macrophages, T –Lymphocytes, and B- Lymphocytes. While macrophages generally travel in the blood, they can exit and reenter to engulf and kill foreign material as well as damaged or aging cells in the body. The B and T cells do the majority of the surveillance for the body. B-Lymphocytes clean up antigens left over from the macrophages and produce antibodies to protect

against a future infection. T- Lymphocytes attack and kill the body's cells that have become infected. A subset of T cells act as memory cells to help the body recall if a particular organism is encountered in the future. Vaccination is an artificially simulated version of what the body does in the event of an infection. The process of vaccination mimics an infection via the introduction of a protein or particle from the potentially infecting organism in order to make the body's T and B Lymphocyte cells generate protection for the body in the event that this organism attempts to enter the body. (Center's for Disease Control and Prevention, 2013) This process allows for an individual to benefit from the protection without naturally encountering the actual illness and avoiding the potential morbidity or mortality associated with an infection. It also allows for herd immunity that occurs when a large number of individuals are vaccinated resulting in protection of unprotected individuals in a community. In the case of Pneumococcal vaccine, a part of the outer sugar-coated capsule is used to induce antigenicity. Influenza, having several vaccines market and occurring in both live- attenuated and killed versions, generally focuses on the hemagglutinin protein to generate antibodies to attack an influenza virus entering the body. (Gomez Lorenzo & Fenton, 2013)

3.2 Pneumococcal Infection

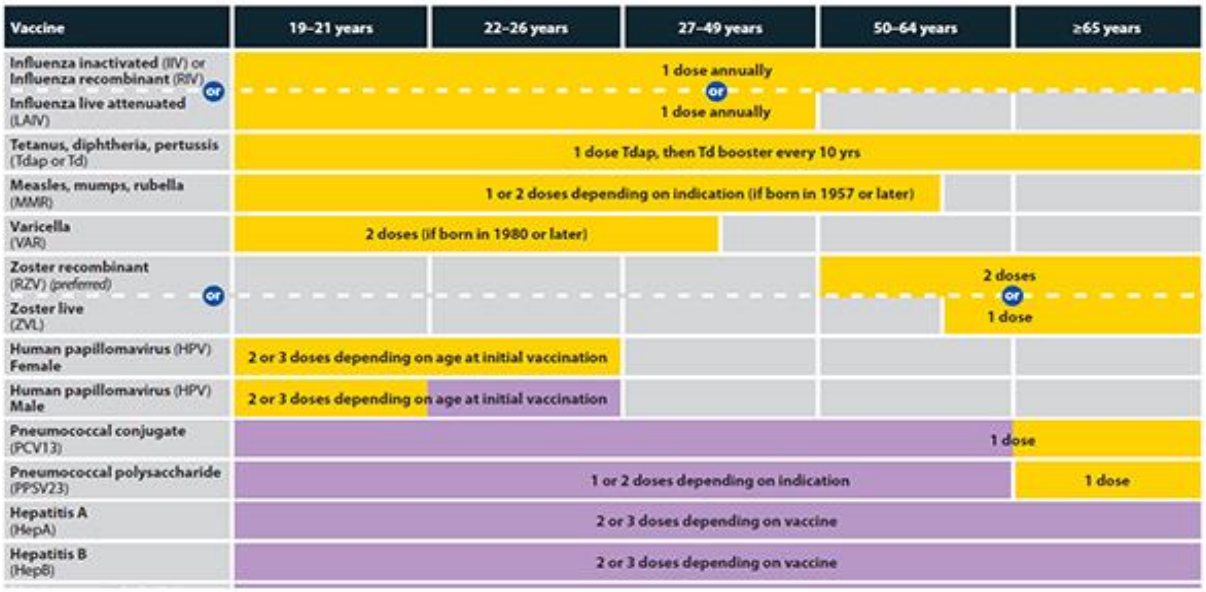
Pneumococcus is a gram-positive spherical (coccus) bacteria spread most commonly by respiratory droplets that are expelled when an infected individual coughs or sneezes. The bacteria commonly cause fever, general malaise, ear, sinus, lung (pneumonia), blood and spinal fluid infections. This bacterium is very prevalent in the younger age groups but affects the older population especially if they have certain risk factors. Generally, any illnesses that compromise

the immune system lend an increased risk of susceptibility to Pneumococcus. These conditions are heart disease, COPD, diabetes mellitus, chronic kidney problems, chronic liver disease, chronic alcohol use, or any chronic illnesses that generally impact the strength of the immune system. (Merck Manual, 2019) Pneumococcal pneumonias are one of the most common causes of death worldwide. In the United States alone it is responsible for 60,000 deaths annually. (Merck Manual, 2019) It is a common co-infector along with influenza and as a result, it is the eighth most common cause of death. Similarly, it ranks as the leading cause of death due to infection in hospitalized individuals. Its significance is staggering. While antibiotics can treat this infection if diagnosed in a timely manner, it has become increasingly difficult to treat Pneumococcus due to increasing antibiotic resistance to commonly used antibiotics. A delay in the initiation of treatment of an individual who may not assume their symptoms warrant attention may make it impossible to beat this illness. Prevention of this infection can be attempted through vaccination. Although there are 90 strains of infectious pneumococcus, 7 strains accounted for the majority of the illnesses in 2000. (Center's for Disease Control and Prevention, 2019) There are two pneumococcal vaccines available; a conjugate PCV13 and a polysaccharide vaccine (PPSV23). Thirteen strains are covered in the PCV 13 vaccine that was released in 2010. PSSV23 was licensed in 1977. Twenty-three strains are represented in the polysaccharide vaccine. There is an overlap of 7 strains found in the vaccines. There are obstacles in regard to prevention of Pneumococcal infections and its associated morbidity. Areas of focus are decreasing the overuse of antibiotics, developing vaccines to cover the unprotected strains, enhanced detection methods through laboratory testing, and increasing the vaccination rates for the currently underutilized PCV-13 and PPSV23 vaccines. Providing a clear message regarding vaccination safety, cost, and insurance related coverage

concerns are hurdles that can be influenced to affect the vaccination rate. (Shen, Warnock, Selna, Chu, & Kelman, 2019)

The recommendations for adult Pneumococcal vaccination are even a bit confusing for most clinicians which may in turn contribute to the decreased utilization of it by the medical community. If individuals 19-64 meet criteria for chronic medical conditions or they smoke cigarettes, then one dose of PPSV23 is recommended. Chronic medical conditions include conditions such as heart disease, lung disease, diabetes mellitus, cerebrospinal fluid leaks, cochlear implants, alcoholism, and liver disease. Ages 19 and older with immunocompromising conditions to include sickle cell disease / hemoglobinopathy, congenital or acquired asplenia, congenital or acquired immunodeficiency, HIV infection, chronic renal failure, nephrotic syndrome, leukemia, lymphoma, Hodgkin's disease, generalized malignancy, solid organ transplantation, solid organ transplant, cochlear implant, CSF leak, or general immunosuppression receive one dose of PCV-13 followed in eight weeks by one dose of PPSV23, but at least five years after any previous PPSV23 administration and again at 65-years of age. Ages 65 years old and older receive one dose of PCV-13 followed by PPSV-23 one year after PCV-13, but at least five years after the last PPSV-23. (Center's for Disease Control and Prevention, 2019) (Table 1)

Table 1 Adult Immunization Recommendations for Pneumococcal and Influenza



A common clinical error is administering PPSV23 every five years. Since the Adult Immunization Collaborative has ended, the ACIP has reevaluated its recommendation and as of June 2019, PCV-13 is no longer routinely recommended. This change was due to a re-review of the current literature with a determination that the overall disease burden is steadily decreasing due to mandatory vaccination of children since 2000. This along with a risk-benefit analysis lead to this change. (Matanock A, 2019)

3.3 Influenza Infection

Influenza is caused by a viral pathogen known to primarily infect the respiratory tract causing a constellation of symptoms: fever, coryza, malaise myalgias, headache. The virus is characterized by its nucleoproteins as type A, B, C and D. C does not cause typical influenza

illness and therefore is not often discussed. D does not usually affect humans. When looking at influenza A and B, there are two major components to the structure of the influenza virus. Hemagglutinin (H) is the surface glycoprotein that allows the virus to bind to host cells and the neuraminidase (NA) which enzymatically dissolves the membrane of the host cells thereby allowing viral release. There are 18 H and 11 NA unique options yielding 198 combinations but only a few affect humans (Merch Manual Professional Version, 2019). While influenza is present throughout the year, it tends to cause seasonal illness leading to epidemics. It is known to cause pandemics periodically and its infectivity is thought to have a pattern. It is spread through respiratory droplets that become airborne with coughing and sneezing. It effects all age groups but has a propensity to cause more complicated illness in children less than four years of age, adults greater than 65-years old, pregnant women, individuals on chronic aspirin therapy, individuals with chronic illnesses especially chronic respiratory illness with impaired clearance of respiratory secretions. Complications of influenza infection are most often pneumonia but can also include encephalitis and Reye syndrome. Influenza is often a co-infector allowing improved susceptibility of agents like pneumococcus and often leading to respiratory failure and possibly death. The Centers for Disease Control and Prevention (CDC) estimated that greater than 700,000 hospitalizations and approximately 50,000 deaths result from seasonal influenza annually with more than 80% of these complications occurring in the 65-year and older age groups (Influenza, 2019 October). Although there have been various antiviral medications developed to help combat the illness, drug resistance has already ensued, and vaccination remains the mainstay of prevention in such an insidious illness. Currently in the US, the ACIP recommends annual, universal vaccination with increased emphasis on high risk groups. The vaccine comes as both trivalent (2 A strains, 1 B strain) and quadrivalent (2A strains and 2 B strains). The type of vaccine comes in

two varieties; a killed inactivated vaccine (IIV) and a live-attenuated vaccine (LAIV). The live vaccine is given intranasally to ages 2-49 with the exception of high- risk individuals, pregnant women, those on long term aspirin therapy and household contacts of immunocompromised individuals. The IIV vaccine is recommended for 6 months of age and older. Both vaccines are contraindicated for those who have had a condition known as Guillain-Barre syndrome. Egg allergy is no longer a contraindication as there are newer recombinant vaccines not grown in eggs and it is thought to be more a theoretical risk for most people with egg protein allergies. (Kelso, 2018)

Vaccination is more commonplace in the pediatric community where prevention of common childhood diseases has become a routine public health intervention to prevent the spread of disease and reduce mortality. This was found to be a necessity as our communities began to grow and become vastly interactive. As of recent there has been increasing pushback from citizens in the community wanting transparency and questioning the requirement of vaccination; citing the right to personal refusal. Despite this newer trend vaccines continue to be encouraged, recommended and in most instances required to participate in school and other organized programs. This volume of vaccine recipients is not replicated in the adult population. While most adults may have received immunizations as children the propensity to continue to receive vaccinations drops off sharply in adults. While about 91% of US children receive appropriate vaccines and/or exemptions (Centers for Disease Control and Prevention, 2019). The National Health interview survey in 2016 states that only 70.4% and 66.9% of adults were vaccinated for influenza and pneumococcus respectively. (Centers for Disease Control and Prevention, 2019)Adults have been accustomed to receiving tetanus immunization for wounds and many may have decided to get vaccinated against influenza, but in 2005 there became a major push to improve

the immunity in adults who due to chronic illness suffer a great deal of morbidity and economic burden from preventable illness. The Healthy People 2020 Goals currently recommend an adult vaccination schedule that includes both universal vaccinations and vaccinations based on risk profiles. (Table1)

3.4 Vaccine Effectiveness/Side Effects

Vaccine effectiveness is a longstanding, familiar, and common concern. It is challenging to place an accurate numerical value on to what degree a vaccine is effective for each person. There are many cofounding factors that complicate the true outcome. Each individual's immune system is unique. Exposures to illnesses and existing risk factors make it virtually impossible to adequately assess this even when controlling for factors that are controllable. Immunogenicity varies per each vaccine. It is generally thought that vaccination with Pneumococcal vaccines protect 60-70 percent against invasive disease. Strains included in the vaccine are capsular polysaccharide: 1,3,4,5,6A,6B,7F,9V,14 19A,19F,18C and 23F. These strains are coupled with a noninfective form of diphtheria that serves as a conjugate which acts to make the body's immune systems more reactive to the foreign material. (Centers for Disease Control and Prevention, 2019)

While it is widely known that influenza vaccine effectiveness varies from year to year, effectiveness remains in the 40%- 60% range. The vaccine has a better track record of reducing the risk of hospitalization from the illness and can even affect the risk of cardiac problems after having had influenza. Effectiveness also depends on which strains are circulating amongst the population at the time with A(H1N1) and B having better protection in most populations than A(H3N2) strains. Other factors affecting the effectiveness of the influenza vaccine include the

health characteristics of the person being vaccinated. In other words, the individual's ability to make adequate antibodies to protect the body will vary. Additionally, congruency of circulating strains with the current year's vaccine play a huge role. If the vaccine given doesn't match the circulating strains it will provide less protection that year. (Rondy, et al., 2017) (Centers for Disease Control and Prevention, 2019) Lastly, the number of people in the population being vaccinated affect the population in general since less circulating disease provides a decreased susceptibility overall for individuals simply by decreased exposure.

3.5 Is Vaccination as Protective as Natural Infection

The CAPiTA trial, a randomized placebo-controlled trial studied the effectiveness of PCV-13, the conjugate vaccine, in a large sample of adults (85,000) over the age of 65 years of age for a 15 year period; it found the vaccine about 45% effective in preventing pneumonia and 75% effective in preventing invasive disease in general. (Musher & Rodriguez-Barradas, 2014) Pneumococcal polysaccharide vaccine can pose some difficulty since only about 80% of adults generate antibodies as a result of receiving it. Additionally, the antibody levels only remain significantly elevated for approximately five years. While elevated it is estimated that protection is 70%. However, those with chronic illnesses may have less protection. (Centers for Disease Control and Prevention, 2019) Often patients feel it may be more effective and safer to get an illness naturally and avoid the unwanted side effects of exposure to chemicals in a vaccine and the injection experience itself. However, exposing oneself to the Pneumococcus can be deadly. Pneumococcal pneumonia is the most common invasive infection due to developing an illness from Pneumococcus and if contracted in conjunction with influenza can yield a 20% death rate.

Post-mortem Pneumococcus was present in 27% of blood cultures from those flu victims. (Blasi, Mantero, PierAchille, & Tarsia, 2012) Additionally, overuse of antibiotics has led to the development of resistance and increased virulence.

3.6 What are Barriers to Vaccination?

Vaccine hesitancy is a well-known phenomenon and understanding the root causes continues to gather interest amongst people in the behavioral health, public health, and medical research communities. Attempting to better understand what behaviors govern individuals to choose to become vaccinated or allow their loved ones to be vaccinated has been studied extensively. Yet, limited research is available studying why adults in the United States particularly may refuse vaccinations generally speaking. An abundance of research is available focusing on the measles vaccination in relationship to children. Influenza studies focus on special groups such as socioeconomically disadvantaged populations or a specific ethnicity. Gleaming information in an attempt to extrapolate some of the outcomes, it seems that misinformation and misinterpretation are huge factors that make individuals refuse a vaccine. Being able to understand what makes patients say no to something is imperative when attempting to affect vaccine hesitancy via a process improvement.

4.0 Literature Review

Plenty of literature exists regarding childhood vaccination and addressing or affecting barriers to vaccination. Less has been written on adult barriers and programs to increase vaccination. The research does address several areas that go into the complexed decision patterns that help dictate whether individuals choose to receive a vaccine. An article by Albert Bach et al, "Addressing Common Barriers in adult immunizations: a review of interventions," determined that when it comes to increasing vaccination rates in adults, reminder systems, access to vaccination, affordability of vaccine, and addressing social, ethnic, or culture differences in vaccination were areas that research has found relevant and thus research has focused on. Based on this literature review, it was generally determined that a multimodal approach is most likely to be effective; one that addresses not one single barrier but as many as possible, given resources. (Albert T. Bach, 2019) Largely it has been determined that reminders via text messaging, phone calls, or cards significantly impact vaccination rates. A review of randomized controlled trials in Medline from 1966-1998 with updates from CINAHL and PubMed up through May 2007 by two independent reviewers looking at 47 studies involving reminder systems found that while there are varying rates of success, telephone reminders yielded the best results however were the most costly option. [adult pneumococcus, tetanus, and Hepatitis B (OR = 2.19, 95%CI = 1.21, 3.99), and adult influenza vaccinations (OR = 1.66, 95% CI = 1.31, 2.09).] (Jacobson Vann, 2005)

Pharmacy based vaccination programs have also been shown to positively impact adult vaccination rates. A study in human vaccines and immunotherapeutic cite that vaccination programs at pharmacies show an increased rate of influenza vaccination particularly among patients who may have previously missed their vaccine last year. This study further breaks down

that both adults under 65 with a chronic condition and those older than 65 with or without chronic conditions show an increase in vaccination rates. Many patients over 65 years of age experienced barriers due to Part D insurance coverage which may have influenced the overall vaccination rate in this subgroup. The under 65-year adult group with chronic illness like the elderly group is likely to seek vaccination per physician recommendation to reduce medical risks associated with comorbid illnesses at a higher rate than young healthy individuals. The study population compared adults from Washington and Oregon states. Again, both states showed an increase in their vaccination rate based on the pharmacy intervention, but Washington state had a 4.7% higher rate of vaccination which suggests that pharmacy vaccination programs do have an overall impact but at varying rates depending on the region. (Burson, Buttenheim, Armstrong, & Feemster, 2016) Standing orders have also been studied in adult populations and found to be an effective way to help capture more eligible patients for vaccination in real time. An article in the American Journal of Infection Control demonstrated a moderate increase in vaccination rates. Measuring a baseline vaccination rate for 5 very different outpatient clinics and then measuring the change one year after implementing standing order protocols (SOPs) a 4-8% increase in rates was reported. These protocols help to alleviate the guess work at each patient encounter by standardizing the process and bypassing the need to obtain a physician order for each individual encounter. Instead the order is inferred based on the patient medical history and guidelines set in place. The vaccines that were standardized were Tdap, influenza, pneumococcal, human papillomavirus, herpes zoster, and hepatitis B. (Tan, VanOss, Ofstead, & Wetzler, 2019)

Studies have looked at what effect educating the physician has on adult vaccination practices by looking at an Internal medical residency. A group of residents were trained versus a placebo group that did not receive additional education on immunizations. This study found no

significant difference in the vaccination rates of their patients. The study did find however that the resident physicians that did receive training felt more confident and more prepared to answer questions they received from patients. (Whitaker, et al., 2018) Educating patients too has varying effects due to the complex nature of the decision making process in an individual.

While there are many approaches to increasing vaccination, a summation of multiple interventions has the multimodal effect suggested by Addressing Common Barriers in adult immunizations: a review of interventions.

4.1 Project Participants

4.1.1 AMGA

The American Medical Group Association (AMGA) was founded in 1950 and is a non-profit group that represents integrated health practices in the United States. Its goal is to help to influence the delivery of," patient-centered, high quality, value driven health care" (American Medical Group Association, 2020). As a result of this mission, the Association spearheads several initiatives with the goal of providing high quality care and attempting to affect the health outcomes of a population rather than just an individual and moving the needle in a positive direction in healthcare. Previous intervention programs that were developed under the AMGA emphasized blood pressure and diabetic care. The AMGA does this by gathering medical groups large and small as participants to collaborate with each other to share tools, pitfalls and resources in order to aid groups in being successful in delivering care with value. Although the AMGA sets goals for each project it strives to see any improvement that results in improved health outcomes, but

ultimately the AMGA ranks the groups and the top three groups present their data. AMGA also joined forces with Optum analytics and Pfizer to help assist the medical groups.

4.1.2 PMA

PMA was established in 1993 and is the largest multi-specialty practice in the Western-Pennsylvania. It is located in the eastern suburbs of Pittsburgh, Pennsylvania. It currently is part of an integrated delivery system (Allegheny Health Network), a division of Highmark Health since 2011. It has approximately one hundred medical providers offering primary care for adults and children as well as several subspecialties including Cardiology, Allergy, Infectious Disease, Podiatry, Pulmonology, Endocrinology, Ophthalmology Radiology, Dermatology and General Surgery. A group that is quality driven, they obtained level three Patient Center Medical Home Recognition from the National Committee for Quality Assurance (NCQA). Premier reported 377,000 patient occurrences in 2017 over 10 office locations (Colangelo, Crossey, Kahn, Kern, & Lyons, 2019).

4.2 The Project Design

In total, 39 medical groups comprised of various mixes of physicians, advanced care providers, nurses and practice managers across the country enrolled to participate. The initiative referenced in this paper was an adult vaccination program targeted at increasing vaccination rates in adults against Pneumococcus and Influenza. Premier Medical Associates (PMA) participated in the Adult immunization Collaborative as one of the practices along with the author of this paper.

The author was involved through a preceptorship with Francis Colangelo, M.D., MS-HQS, the director of Quality at PMA, along with a group which included a nurse, another PMA physician, and an electronic health record technician. Again, the goal of the collaborative was to increase the pneumococcal and influenza vaccination rate for adults in accordance to the AMGA collaborative guidelines. (Appendix A, B) The guidelines chosen by the AMGA were adapted from healthy people 2020. The guidelines specified that the project's success be hinged upon three principles: education (provider and patient), targeted outreach, and implementation of standing orders. A tool kit was provided to aid with formulating ideas for each category. Additionally, the Center for Disease Control and Prevention's (CDC) website was referenced for the current recommendations from the Advisory Committee for Immunization Practices (ACIP) for standard immunization guidelines. The Collaborative was one year long with a three-month post period to capture and report data. Three months prior to the onset of the AI Collaborative, a joint meeting amongst groups was held in Ohio where all the groups were educated on the incidence, prevalence, and morbidity associated with both Pneumococcus and Influenza. The groups were provided with helpful algorithms in order to clearly identify the target groups requiring vaccination. Several additional webinars were given in January 2017 prior to the group's launch. The toolkit provided suggestions to help direct focus on changes that might have the greatest impact on program successes. It also provided data mining support. The groups were to develop their own strategy to improve vaccination by implementing a plan from each of the categories: Provider Education, Patient Education, Information Technology, and Clinical Support. The categories were further subdivided into levels. An intervention was required on each level that was offered. The categories measured for this collaboration were:

1. Patients 65 years of age or older who received any pneumococcal vaccination with the healthy people 2020 goal 90% and collaborative goal 90% (measure1)

2. Patients 65 years of age or older with both Pneumococcal polysaccharide vaccine (PPSV) and pneumococcal conjugate vaccine (PCV) with healthy people 2020 goal 90% and collaborative goal of 60%. (measure 1)

3. Patients 19 to 64 years of age with immunocompromising chronic conditions (Appendix G immunocompromised conditions placing patients at High Risk), cerebrospinal fluid leaks or cochlear implants with healthy people 2020 goal 60% and collaborative goal (45%) (High Risk)(measure 2)

4. Patients 19 to 64 years of age with decreased immune function (Appendix G immunocompromised conditions placing patients At-Risk](measure 2A- optional)

5. Influenza vaccination with a collaborative with the Healthy people 2020 goal at 70% and the collaborative goat at 45%. (Table 2) (measure 3)

Table 2 Collaborative Goals Compared to Healthy People 2020 Goals

Measure	Healthy People 2020	Collaborative Goal
Measure 1 (65+) Any	90%	90%
Measure 1 (65+) Both PPSV and PCV*	90%	60%
Measure 2 (High-Risk)	60%	45%
Optional Measure 2a (At-Risk)**		
Measure 3 (Flu)	70%/90%***	45%

* Increasing "Both" is a good goal for Groups which are already doing well on "Any"

** According to CDC guidelines, it is not currently recommended that the at-risk population receive PCV. Therefore,"PPSV" or "Unknown pneumococcal vacination" are numerator options for Measure 2a.

*** 70% for all patients, 90% for Medicare patients

(Taken from Premier Medical Associates adult immunization (AI) Best Practice Learning Collaborative, Group 2: Case Study (2019) with permission)

Although the Collaborative's goals were extracted from the Healthy People 2020 goals, they were modified due to the short duration of the project. The goals were predetermined by the

collaborative organizers based on what degree of improvement that could realistically be accomplished in a year's time.

Provider Education

Upon returning from the preparatory session, PMA held an All Provider meeting to educate the providers via a PowerPoint presentation which identified the populations to vaccinate with similar statistics about the illnesses as well as barriers to vaccination. This being a multispecialty group, it was emphasized that not just the primary care providers should attempt to engage a patient in regard to vaccination, but to offer it to them as it relates to the scope of their practice. For example, an Allergist may encounter patients with asthma therefore offering vaccine for prevention of influenza is best practices guidelines and within scope of practice. Similarly, a Pulmonologist may see the need for prevention of both pneumococcus and influenza related illness. It was emphasized that universal vaccination for influenza is recommended by the ACIP. Additionally, PMA's AI Collaborative group also informed the providers that there would be transparent reporting starting before the collaborative to prepare the providers and allow them time to develop a routine regarding their vaccination practices. A monthly report of all providers in each department would be distributed and posted. Additionally, support would be offered for providers consistently unable to show results in alignment with their peers.

Staff Education

The guidelines for the AI Collaborative required a staff education piece, so in addition to the re-education piece provided to the providers, two other areas of education were the focus. Education was developed for the support staff of each of the offices. The presentation was abbreviated from the larger one provided to the provider staff and the three physicians in PMA's

collaborative rotated to each of the offices to give the education piece to each group during their staff meetings. This was thought to be a big component of the program since the support staff's attitudes toward vaccination even if unspoken would have a large impact on how the vaccine would be received by the patients they were caring for. In order to tailor the presentation to the staff, a survey was developed on survey monkey and sent to staff to gather questions, myths and concerns regarding vaccinations. (Appendix C) The questions that were similar in content were grouped together and most were incorporated during the educational PowerPoint presentation. Any additional questions were addressed during the post discussion. The staff was then given short phrases or talking points to use when patients asked them questions regarding the vaccine efficacy or safety. They were also encouraged to refer the patient to have further discussion with their provider. The desired approach was to have the patient receive a unified and consistent message regarding vaccination. The patient care workflow was redesigned to open the conversation regarding the vaccines needed at the beginning of the visit along with giving the information sheets that were discussed in the patient education section. (Appendix D,E) It was also an opportunity for the support staff to streamline the vaccination process if the patient was interested in vaccination so that it could occur even before meeting with the provider and therefore more of the visit could be used to address other medical concerns.

Patient Education

It was expected that three levels of patient education be provided. First, an adult immunization fact sheet was created as tear-off (Appendix D, E) to be offered for patients in the office while they were waiting for their appointments. This sheet was prepared in alignment with the information given the staff to add to congruency of the message. The information on the fact sheet was created in conjunction with information given from the toolkit and from the CDC

websites. Next a message regarding pneumococcal morbidity and the possible need for a vaccine was added to the patient portal for relevant age groups. (Appendix F) The message was viewed if the patient logged onto their healthcare portal for any reason. It encouraged the reader to call their primary care provider's office to see if they are protected. The final education piece involved implementing a rolling message on the phone lines to share times and locations for obtaining the influenza vaccination. The tear-offs and the electronic message provided reference details and visual reinforcement regarding the needed vaccination.

Information Technology

To meet the requirements for information technology at all levels, standardization of documentation in the electronic medical record and tracking of the patient's immunization status via an electronic dashboard were two workflow protocols that were in place and had been routinely used in the past. As a result of using them to capture a patient's immunization status in real-time and then immediately encourage vaccination while in the office, this portion of the program was effortless. Providers and their clinical support teams were reminded to check the electronic dash boards in the electronic health record to see if the patient needed either vaccine when preparing for the patients encounter for the following day. This method is equivalent to what is considered point of care alerts or electronic reminders. The dashboard also served to generate the monthly transparency reports that were discussed above. Additionally, the power of electronic medical records was utilized to obtain registries of patients that were deficient in both pneumococcal and influenza vaccines. The support staff then called these patients and attempted to schedule them for a visit to obtain their needed vaccine. Optum analytics also provided several automated call sessions via an artificial intelligence phone tool called Expectation Management and Medical Information (EMMI) at various times of day in order to attempt to reach a larger range of patients.

Clinical Support

The goal for clinical support was to ultimately help to intertwine the loose ends that regularly occur in patient care and to help to make each patient interaction a successful opportunity to get the patient vaccinated. To do this, it required keeping the staff healthy by administering flu vaccine to them and thereby creating a layer of protection for the patients they would encounter as well; some of which had weakened immunity. Intensive discussions surrounding mandating vaccine for staff occurred but ultimately an incremental approach was felt to be warranted given the instability of the staff volume. Next, care coordinators would call eligible patients or talk to patients who called in for other matters and offer to assist them in scheduling for vaccination. Standing orders overlapped with staff education. It was instituted so that after the staff had been thoroughly educated to address vaccine questions, they could proceed with vaccination without waiting for a doctor's order. The final piece for the clinical support staff was to seize the opportunity to vaccinate patients while in the office regardless of the reason for their visit which often wasn't related to vaccination. There were additional opportunities for patients to get a flu vaccine with flu clinics done at multiple Premier sites with a variety of extended hours for convenience. The flu and pneumococcal vaccine were offered to all patients being discharged from the hospital. When appropriate, that updated immunization status was coordinated with skilled nursing facilities caring for those patients. The criterion also had a compensation component. This was not a main focus of the collaboration for PMA yet still an important one. Affordability of vaccines is a serious concern for patients and recouping the cost of administering the services is imperative in keeping a business operational. These aspects were handled by the revenue cycle team based on ICD-10 codes that the electronic health record team selected with

guidance from the toolkit. There was no interaction with the author and the revenue cycle team, and this was not a focus of this paper.

Results

The results show that Premier exceeded all goals set by the AMGA for measures 1, 2 and 3. (Tables 3-6) Optional measure 2a. had no set goal but was reported as a useful measure that an organization could use to follow the at-risk population of patients that they care for. Prior to the official start of the measuring period Premier had met the target goals in both measure 1 and measure 3, during the collaborative the vaccine rates continued to increase with no plateau. These results were later shared with collogues that also participated in the collaborative in an effort to learn for successes as well as pitfalls experienced with the common goal of improving patient outcomes. Organizations participating varied in size from similar sized medical practices to larger institutions. Although the groups must remain anonymous, Premier showed the largest improvement compared to all groups. (Table 8)

Table 3 Measure 1 Results - Both PPSV and PCV Immunization for Adults Ages ≥ 65

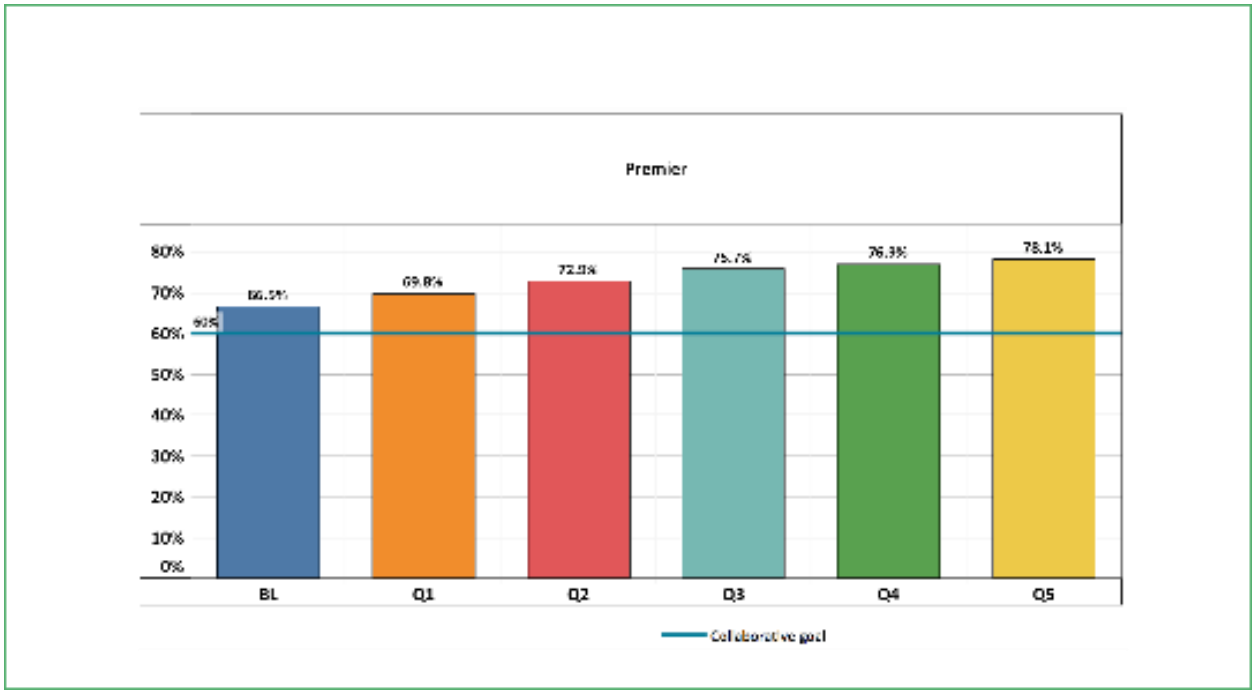


Table 4 Measue 2 Results - Pneumococcal (Any) Immunization for Adults ages 19-64 with High Risk

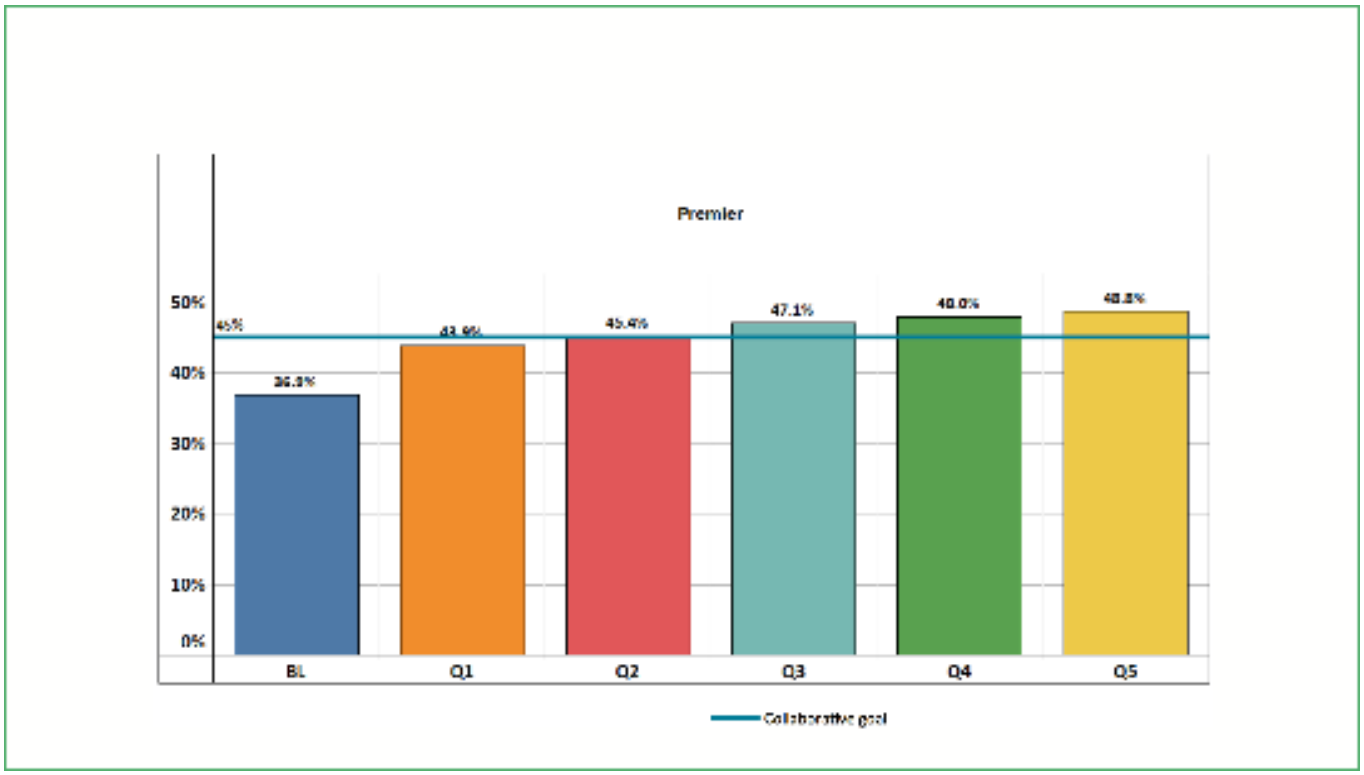


Table 5 Measure 2A Results - Pneumococcal (Any) Immunization for Adults Ages 19-64 with At-risk Conditions

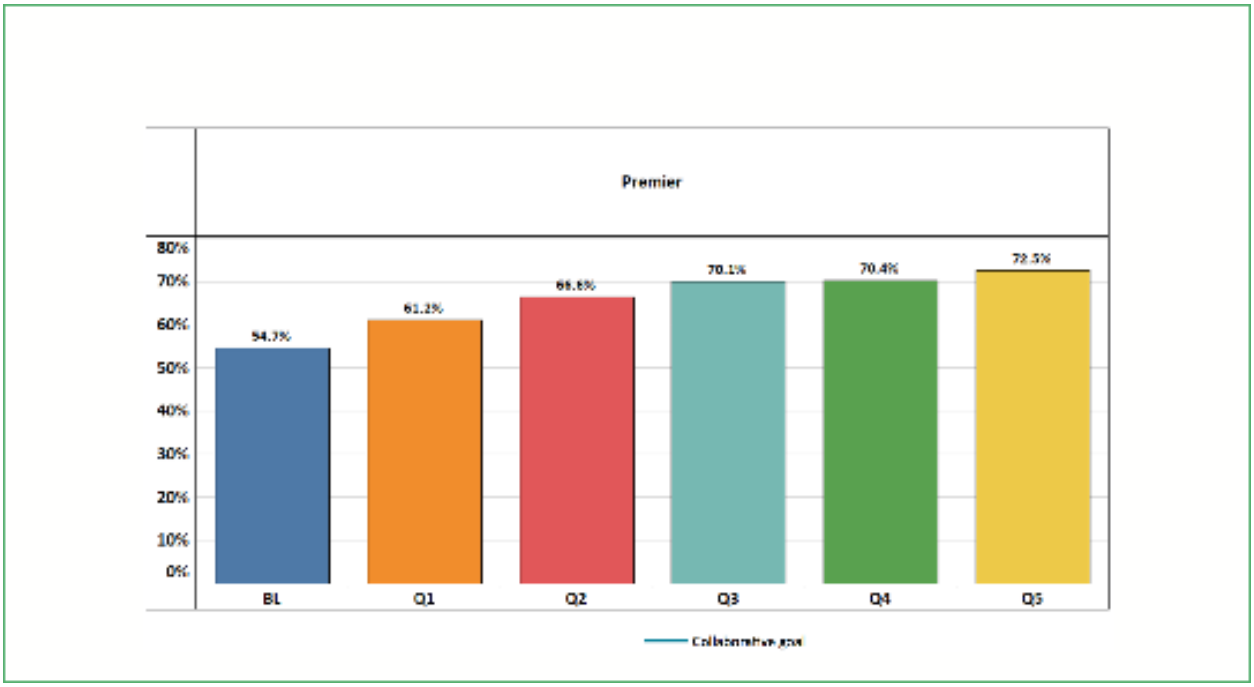
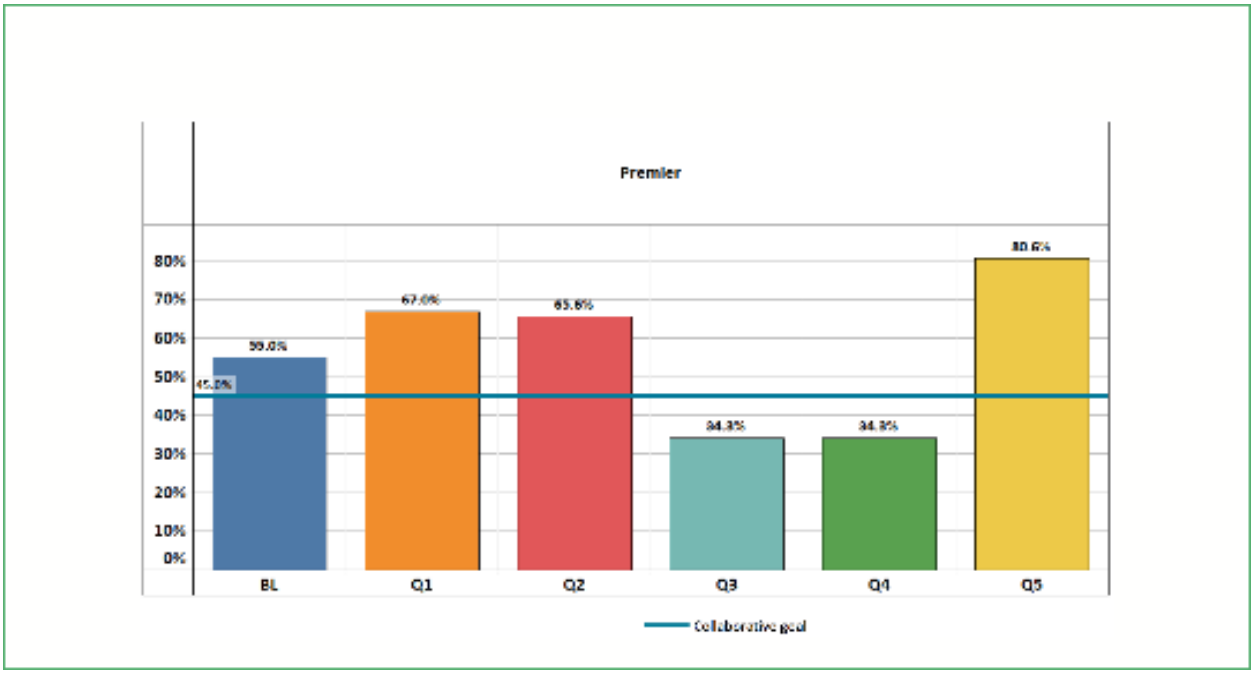


Table 6 Measure 3 Results - Influenza Immunization, Age ≥ 18



During the study, the robotic call tool better known as EMMI contacted 5707 patients in total who were deemed eligible to receive vaccination based on the information harvested from the Allscripts electronic health records. (Table 7)

Table 7 EMMI Phone Results

Population	# Patients Identified	# Engaged	% Engaged	Engaged Patients Vaccinated	% Engaged Patients Vaccinated
65+, needing one or more	1,295	524	40.5%	215	41%
19 – 64 high risk needing one or more	840	592	70.5%	112	18.9%
19 – 64 at risk ONLY needing one or more	5,702	2676	46%	935	34.9%

(Taken from Premier Medical Associates adult immunization (AI) Best Practice Learning Collaborative, Group 2: Case Study (2019) with permission)

The robocall message was personalized with the patient's provider information and successfully contacted two thousand six hundred and seventy-six patients (46%) resulting in nine hundred and thirty-five patients (34%) receiving vaccination for one or more of the vaccines for which they were eligible. The system offered an option of conveniently speaking directly to a staff member during normal hours to schedule or alternatively calling for an appointment later. The latter option was offered solely afterhours. At the conclusion of the study, the results were generated by obtaining the data from the Allscripts software in collaboration with Optum Analytics**.**

Table 8 Final Premier Results Compared to Collaborative Goals

Measure	Healthy People 2020	Collaborative Goal	Premier Medical Associates
Measure 1 (65+) Any	90%	90%	95.7%
Measure 1 (65+) Both PPSV and PCV	90%	60%	78.1%
Measure 2 (High-Risk)	60%	45%	48.8%
Optional Measure 2a (At-Risk)			72.5%
Measure 3 (Flu)	70%	45%	

(Taken from Premier Medical Associates Adult Immunization (AI) Best Practice Learning Collaborative, Group 2: Case Study (2019) with permission

5.0 Discussion

It is safe to say that Premier's efforts to implement changes through the education of physicians, support staff and patients were successful. Looking at the project as a whole, transparency was a large contributor to its success. Based on a prior Human papilloma virus (HPV) improvement initiatives done by Premier it was noted anecdotally that posting each provider's results seemed to drive the efforts such that the top providers tried to stay of top and the lower providers brought up their results by the next reporting period. This is also seen annually with influenza vaccination. Collectively, each person's efforts of trying not to appear to have the weakest performance moves the group as a whole towards its efforts.

Telling the physician that their metrics would be followed and shared with their colleagues made a huge impact on their behavior. It is a phenomenon that Premier witnessed during other improvement projects that they participated in. It appears that most physicians prefer not to be at the lower end of performance outcomes and feel ashamed in a way when they are not at the top. While this is not the sole reason for their performance, it is certainly a contributing factor. Other elements that lead to such positive outcomes were educating the staff to display a message that was harmonious in its delivery by everyone interacting with the patient. By no means does that imply that all skepticism that the patient had was dissolved, but it seems to resonate with some patients and made them reconsider vaccination if there was any room to budge them. Affecting this skepticism is a much harder task when it comes to a vaccine such as influenza. While acceptance for the Pneumococcal vaccine uptake fell higher, influenza vaccine continues to seem stigmatized. The concerns that it may cause illness or debility plagues it along with its need for recurring revaccination. So many people have a level of discomfort with this vaccination and the

ability to counteract doubt with fact and a repetitious message must remain the goal. Meeting the staff where they were by specifically addressing the questions they had and giving them responses to use when they encountered patients with similar feelings was crucial. EMMI was a tremendous addition to the outreach part of this project. Robocalling can reach a far greater number of patients in a shorter amount of time as compared to manually calling. It provided the game changing ability to call multiple times even during off hours. The personalization of the messages gave a feel that each patient was receiving a message directly from his/her provider. Even though people often don't prefer automation to a personal touch EMMI did get engagement in a large number of eligible participants and it clearly impacted the outcomes. The use of EMMI freed our support staff to call those who were eligible to receive vaccine but did not engage with EMMI. EMMI made this subset of patients a more manageable number. It was decided on certain time blocks for EMMI to begin calling. Selection of certain times generated a selection bias and perhaps impacted the number of responses since selecting particular periods may eliminate those who may not routinely be home to accept a call during that period. There is no way to completely fix this barrier but call times were staggered in an effort to reach some patients during the day and in the evening. Not every practice group involved in the AI chose to utilize EMMI. The case study was performed by various sizes and types of practices and there were vast differences in the vaccination rates. Result variability was multifactorial but since each group choose what plans they were planning to implement from each category it is difficult to speak on exactly why one group had a certain outcome over another one. The results of each group were not able to be shared nor is it really relevant to Premier's outcomes since each group worked individually. The salient point is that while Premier's population health successes were significant, they are not generalizable. It was not easy to separate out what degree of impact was made by each change: education, SOP's,

messaging and reminders. Doing all of them simultaneously had an additive effect. While all other groups experienced some improvement in their adult immunization rates, other factors such as patient demographics and regional related differences may have affected outcomes. Moreover, the goal would be to use the information learned from this collaborative and its generalities to effect change by instituting reminders, education, SOP's, and transparency. Fortunately, Premier's experience in collaboratives along with a certain work culture helps them to continue to do well in theses collaboratives thus helping them to deliver a higher quality of care at a lowest cost.

6.0 Limitations

When looking at areas that presented a heavy lift for the programming team, it can definitely be said that the leanness of the group presented a problem. The group was comprised of the Quality Director, a quality clinician, two physician team members, and an information technologist. Other teams had a greater number of participants and therefore they could distribute various tasks amongst a wider array of people and additionally had more people to help brainstorm ideas to meet goals. Thankfully most of the team had been involved in population health initiatives before. As a result, they knew how to streamline different aspects of the project and had knowledge regarding what types of tasks didn't seem to work for Premier in the past given the patients population-provider mix.

While robocalls helped to reach a large number of people in a short time, the times chosen to send the calls presented a selection bias. There were times that the calls went out and some people may not have been home to answer. An attempt to rotate times was done but could not guarantee that everyone eligible would be contacted. Furthermore, there are individuals who hang up on computerized calls which hinders their engagement with the phone service. As reported earlier, limited manpower prohibits a staff person from calling a large number of people and the number of staff available on any given day for vaccination, calls, or any other related duties can vary from day to day.

It is probable that more patients were vaccinated than were captured, but we were unable to know to what magnitude because if they were vaccinated at a local pharmacy, the pharmacy does not automatically share that information with the patient's provider. There is a large number of pharmacies in the area depending on insurance practices so trying to obtain that information

would be best done through a policy change mandating that information be shared instead of the current protocol of relying solely on the patient who may have the best intentions to give this information to the provider. Another care gap that was exposed is the lack of bidirectional reporting between Premier's electronic record with other medical services as well as the absence to a statewide immunization registry with bidirectional reporting. Without bidirectional communication between electronic health systems, a patient can receive a vaccination at a retail store, pharmacy, or at urgent care, but the recipient does not have that information automatically transmitted to the patient's primary care provider. Automatic transmission helps to keep records up to date to prevent a vaccine from being administered in duplicate. Such software is under development for different medical record systems to have the ability to be able to share data in real-time. The statewide registry can act as a database to store patient immunization records and to make them accessible for any provider or the patient themselves. Pennsylvania does have a registry, but unfortunately it is only collecting data at the time of this project. Its collections are not bidirectionally shared.

7.0 Conclusion/Recommendations

Every participant group in the AI collaborative noted improvements on some level. Our results exceeded the collaborative goals. This can be contributed to the multimodal approach allowing each change to contribute to yielding some level of improvement. While it is unclear to what degree each change contributed, it is probable that each change had some effect. Not every intervention started simultaneously, yet we were able to see improvements throughout our monthly monitoring. Reminder phone calls have been scientifically shown to increase vaccine rates. Our robocall engaged 40-70% of each group with 19-40% of the groups being vaccinated as a result. Other reminders were also done manually from nurses who reviewed lists of patients who may be eligible for vaccine but hadn't had some contact with the medical office or responded to outreach. The staff calls were more personal but are more expensive and labor intensive. The SOP's helped to make it easier for those patients coming in to receive vaccination without waiting to see the doctor. Additionally, if patients were in the office for other reasons, they could conveniently be vaccinated it desired. Flu clinics eliminated the need for an appointment. All of these changes removed barriers to vaccination. It is difficult to translate what educating the providers and staff did for the overall immunization rates. Making the staff comfortable to be able to engage the patient on a topic that may bring some resistance is difficult, but it at least starts the conversation and dispels myths.

Based on this process improvement, it is recommended to continue a reminder system that can call a large number of eligible patients for vaccination based on information harvested from the electronic health record. It is important to maintain the staff education in an annual training and for new hires and to help keep their educational message current. Standard order protocols

help streamline the interoffice process and should continue. Transparent reporting amongst physician has remained successful, is easy to maintain, and should continue. It helps to keep an expectation present. Lastly, it would be very advantageous to work on a system to automate pharmacy vaccination information or at the very least have a pharmacy employee have a responsibility to send this information to the patient's healthcare team. This project serves to demonstrate some interventions that improved vaccination outcomes. While there were many other things that could have been done to increase the vaccination rates, general education of all that are involved, outreach to help the patient engage and understand the vaccine's importance, and attempting to remove barriers to receiving the vaccine can work to increase rates in a population.

Appendix A AMGA Participation Guidelines

AMGA

AMGA Foundation

All participating organizations must be an AMGA member and in good standing in order to participate in the Collaborative. If while participating in the Collaborative the organization's membership status is terminated, the organization will not be able to continue in the Collaborative.

Either party may terminate their participation in this agreement without cause with thirty (30) days written notice. In the event this Agreement is terminated or the organization's AMGA membership status is terminated:

- The organization will return a proportionate share of the educations grant received not yet applied toward the Collaborative based on months participated.
- AMGA Foundation may retain any de-identified and aggregated data submitted during the course of the Collaborative, but shall return any business or confidential and proprietary information at the reasonable request of the organization.

b. AMGA Foundation

AMGA Foundation agrees to direct the project, provide technical support and training to participating organizations, and coordinate all communication among project participants. AMGA Foundation will also be responsible for awarding the organizations with an educational honorarium to support its efforts.

3. Responsibilities of the Participating Organizations

a. Premier Medical Associates will:

Tasks		Due Date
• Execute MOU between participating organization and AMGA Foundation		December 23, 2017
• Create an implementation team responsible for the project and identify key program contacts, e.g.,: - Quality key contact - Data key contact - May include: physician champion, advanced practice clinicians, nurses, pharmacists, social worker, care manager, quality improvement specialists, data/IT analyst, revenue services manager, etc. • The organization will provide AMGA Foundation with full contact information for each team member.		December 23, 2017
• Complete W-9 and provide to AMGA Foundation.		December 23, 2017
• Participate in AI Collaborative Data Webinar		January 19, 2017 3:00pm-4:30pm ET
• Participate in AI Collaborative Orientation Webinar		January 31, 2017

2

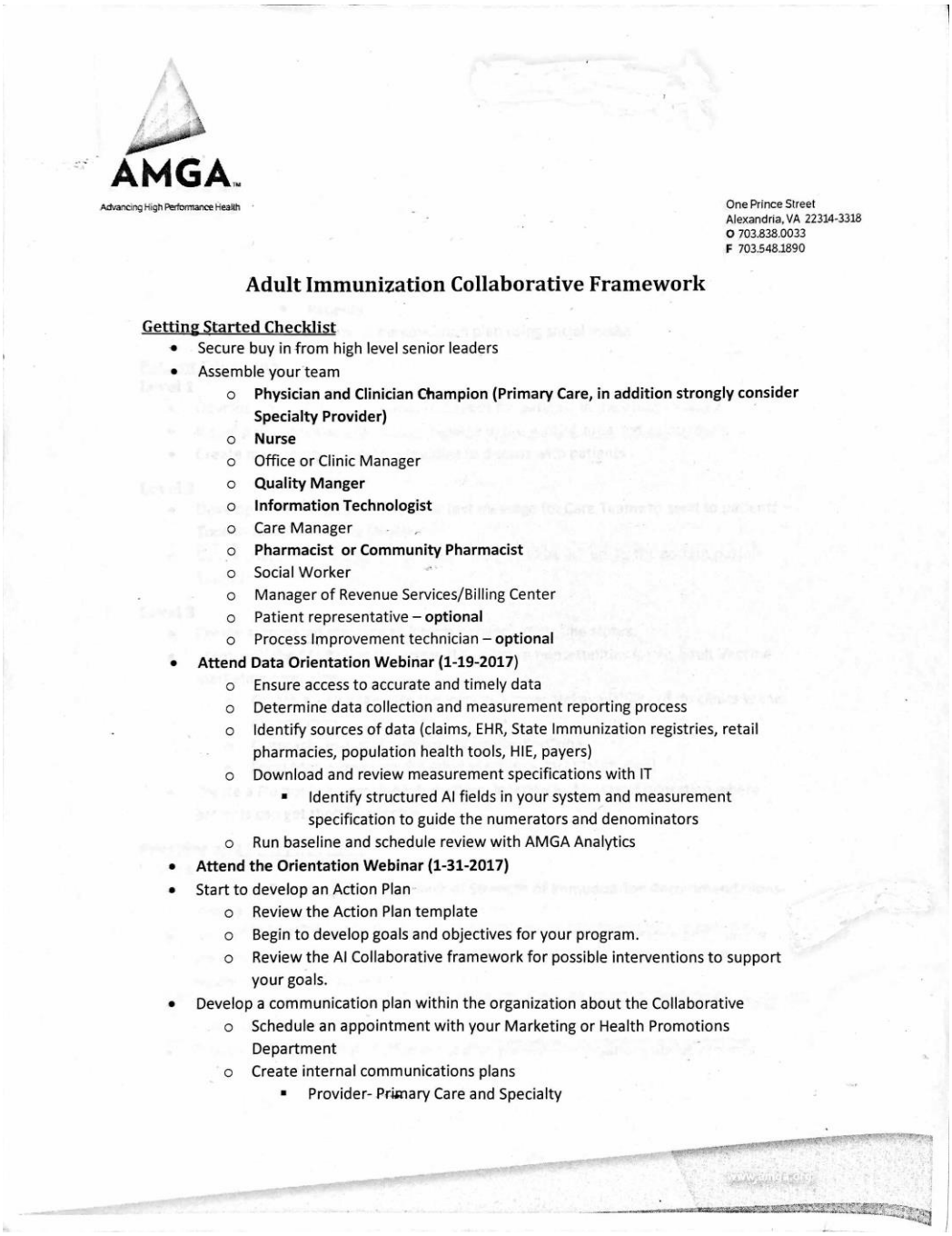
		3:00pm-4:30pm ET
• Complete Getting Started Checklist and review with AMGA Foundation		January-April 2017
• Participate in first in-person meeting, *Cleveland, OH*		April 26-27, 2017
• Participate in all additional Collaborative activities: monthly webinars to share project process and findings, listserv discussions		May 2017 – April 2018
• Submit project progress updates. A PowerPoint template will be provided by AMGA Foundation.		
• Share tools, insights, and protocols related to the project.		
• Submit baseline and quarterly on reporting measures (see Exhibit A).		
• Engage in open dialogue and discussion with other project participants.		
• Submit periodic action plans (due July, October, and January) and review with AMGA Foundation via conference call.		
• Host AMGA Foundation for on-site visits (if identified for visit).		
• Participate in last in-person meeting, *location & date TBD*		
• Conclude the project no later than October 2018.		
• Work with AMGA Foundation to develop Best Practices Case Studies for dissemination to broader group of health care organizations.		April 2018
• ***Additional Responsibilities include:***		April 2018 – July 2018
• Release the sponsoring organizations (AMGA Foundation, Pfizer, and Optum Analytics) from all claims of copyright infringement due to publication and/or repacking for distribution of any portion of the application and resulting tools and materials, other than those you designated in your application as proprietary. • AMGA Foundation, Optum Analytics and Pfizer agree not to publish any such designated confidential and proprietary information without your prior written approval and consent. Publications include: - Best Practices Case Studies - White Papers		
While participating in the Collaborative activities, AMGA Foundation and the Participating Organization agree not to share any Protected Health Information (PHI).		
• Implement the project as outlined in your application.		

4. Financial Compensation

AMGA Foundation will award participating organizations with honoraria to support its program efforts.

- Participating Organization Honoraria: $10,000
  - $5,000 to be mailed by 1st QTR 2017

Appendix B AMGA Collaboration Guidelines



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One Prince Street
Alexandria, VA 22314-3318
O 703.838.0033
F 703.548.1890

Adult Immunization Collaborative Framework

Getting Started Checklist

- Secure buy in from high level senior leaders
- Assemble your team
  - **Physician and Clinician Champion (Primary Care, in addition strongly consider Specialty Provider)**
  - **Nurse**
  - Office or Clinic Manager
  - **Quality Manger**
  - **Information Technologist**
  - Care Manager
  - **Pharmacist or Community Pharmacist**
  - Social Worker
  - Manager of Revenue Services/Billing Center
  - Patient representative – **optional**
  - Process Improvement technician – **optional**
- **Attend Data Orientation Webinar (1-19-2017)**
  - Ensure access to accurate and timely data
  - Determine data collection and measurement reporting process
  - Identify sources of data (claims, EHR, State Immunization registries, retail pharmacies, population health tools, HIE, payers)
  - Download and review measurement specifications with IT
    - Identify structured AI fields in your system and measurement specification to guide the numerators and denominators
  - Run baseline and schedule review with AMGA Analytics
- **Attend the Orientation Webinar (1-31-2017)**
- Start to develop an Action Plan
  - Review the Action Plan template
  - Begin to develop goals and objectives for your program.
  - Review the AI Collaborative framework for possible interventions to support your goals.
- Develop a communication plan within the organization about the Collaborative
  - Schedule an appointment with your Marketing or Health Promotions Department
  - Create internal communications plans
    - Provider- Primary Care and Specialty

Page 1

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- Staff
- Patients

  - Create external communication plan using social media

Patient Education

Level 1

- Develop an Adult Immunizations fact sheet for patients in the office - *Toolkit*
- Install pneumonia and flu vaccine signage in the waiting area and exam room.
- Create messaging during daily huddles to discuss with patients

Level 2

- Develop outreach letters, email and text message for Care Teams to send to patients – *Toolkit- Reminder Letter (NFID)*
- Develop an Adult Vaccine Information message to be added to the patient portal- *Toolkit*

Level 3

- Create automated message to inform patients of vaccine status.
- Meet with the Marketing Department to explore opportunities for an Adult Vaccine marketing campaign
  - Create a web page with the locations, time and availability of flu clinics within organization.
  - Outreach through Facebook, Linked in, YouTube
  - Local Media coverage for Adult vaccines - local TV channel
- Create a Flu hot line - provide information, location and hours of operation where patients can get their flu vaccine

Provider and Staff Education

Level 1

- Conduct a Provider Self- Assessment of Strength of Immunization Recommendations- *Toolkit*
- Attend individual department meetings to introduce the collaborative and provide educational materials on pneumonia and flu vaccines based on CDC and ACIP recommendations - *Toolkit*
- Provide clinical staff with educational materials on pneumonia and flu vaccines based on CDC and ACIP recommendations. – *Toolkit*
- Provide talking points to staff to assist with patient conversations about vaccines

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Level 2

- Share AI Collaborative data with staff, providers and committee to monitor vaccine improvement rates and ensure the collaborative remains a focus
- Share transparent gap reports with providers and clinical staff daily, weekly or monthly
- Adopt a pneumococcal vaccine algorithm based on CDC and ACIP recommendations – *Toolkit (examples – CDC; EZIZ.org; Riverside; Everett Clinic)*

Level 3

- Have your Physician Champion attend Specialty Department (Cardiology, Infectious Disease, Pulmonology) meetings to provide information about At Risk and High Risk patients identified as needing a pneumonia vaccine. *(Toolkit- Immunization Action Coalition, Optum One)*
    - Gain consensus among providers as definitions of At Risk patients or High Risk patients.
- Develop new protocols and procedures for vaccine administration
    - Train staff to provide pneumonia and flu vaccines
    - Physician to physician training via meetings and emails
- Educate and train Specialty departments (administer vaccines, document in EMR, order vaccines and proper handling and storage)

Information Technology

Level 1

- Standardize vaccine documentation in the EMR
    - Create discrete field for documentation of pneumonia and flu in the EMR
- Create a dashboard to track compliance scores and identify patients that are due for immunizations

Level 2

- Create point of care alerts for providers and staff for patients with vaccination needs
    - Create BPA to initiate PPSV23 and PCV 13
- Include "Declination for Vaccine" field in EMR – *Toolkit- Possible "Standardized" Reasons for Declining Adult Vaccination; CDC- Adult Immunization Contraindications and Precautions Schedule*

Level 3

- Investigate state registry and practice capabilities for bidirectional sharing of vaccine information into EMR
- Investigate the possibility of data sharing with pharmacies or other clinical settings through direct messaging
- Use a population registry to identify patients who need a flu or pneumonia vaccine

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- Identify pneumonia vaccine –naïve patients
- Identify At risk and High Risk patients

Level 4

- Consider utilization of bar code technology
- Review hospital admissions for pneumonia

Clinical Support

Level 1

- Ensures adequate vaccine stock is available for flu season - communicate with pharmacy/materials management
- Provide gap reports to Care Coordinators/ Clinical staff for outreach to selected (HR) patients to schedule a vaccination appointment.
- Provide vaccine information and opportunities for employees to receive a flu vaccine. – *Toolkit – Flu and Pneumonia Vaccine information*

Level 2

- Develop standing orders for patients to receive vaccines by clinicians (RN and Pharmacist)-*Toolkit - GSA/IAC*
- Redesign staff workflow to address patient immunization status at beginning of every visit
  - provide care managers with weekly list of upcoming appointments
  - identify patients needing vaccinations during morning huddles
  - prepare for pt.'s arrival and assist with vaccination

Level 3

- Initiate seasonal Flu clinics to include pneumonia vaccine
  - Extend hours and add additional locations for flu vaccine.
- Perform AWV visit
  - Pre-plan for visit using compliance reports to identify patients needing a vaccine during visit
  - Explore opportunities to use pharmacist or nurses to conduct AWV and to provide vaccines.
- Provide Immunization only nurse home visits.
- Provide flu and pneumonia to patients prior to discharge from the hospital
- Share data with SNF partners
- Explore Provider/Practice Payment Compensation (ex. attach measures to physician scorecard)
- Mandate staff vaccinations

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Alexandria, VA 22314-3318
O 703.838.0033
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Compensation

Level 1

- Run monthly immunization revenue and denial reports, to monitor trends and make adjustments or corrections as needed.
- Share reports with each PC and Specialty Departments

Level 2

- Provide coding and billing education and tools to staff

Appendix C Survey Monkey Flu Vaccine

QUESTIONS RESPONSES 2

Flu Vaccine Survey

Thank you for participating in our survey. We hope you will answer honestly

Please fill this quick survey and let us know (your answers will be anonymous)

The flu shot can cause the flu. *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

It's better to get the flu shot towards the end of the year, closer to flu *

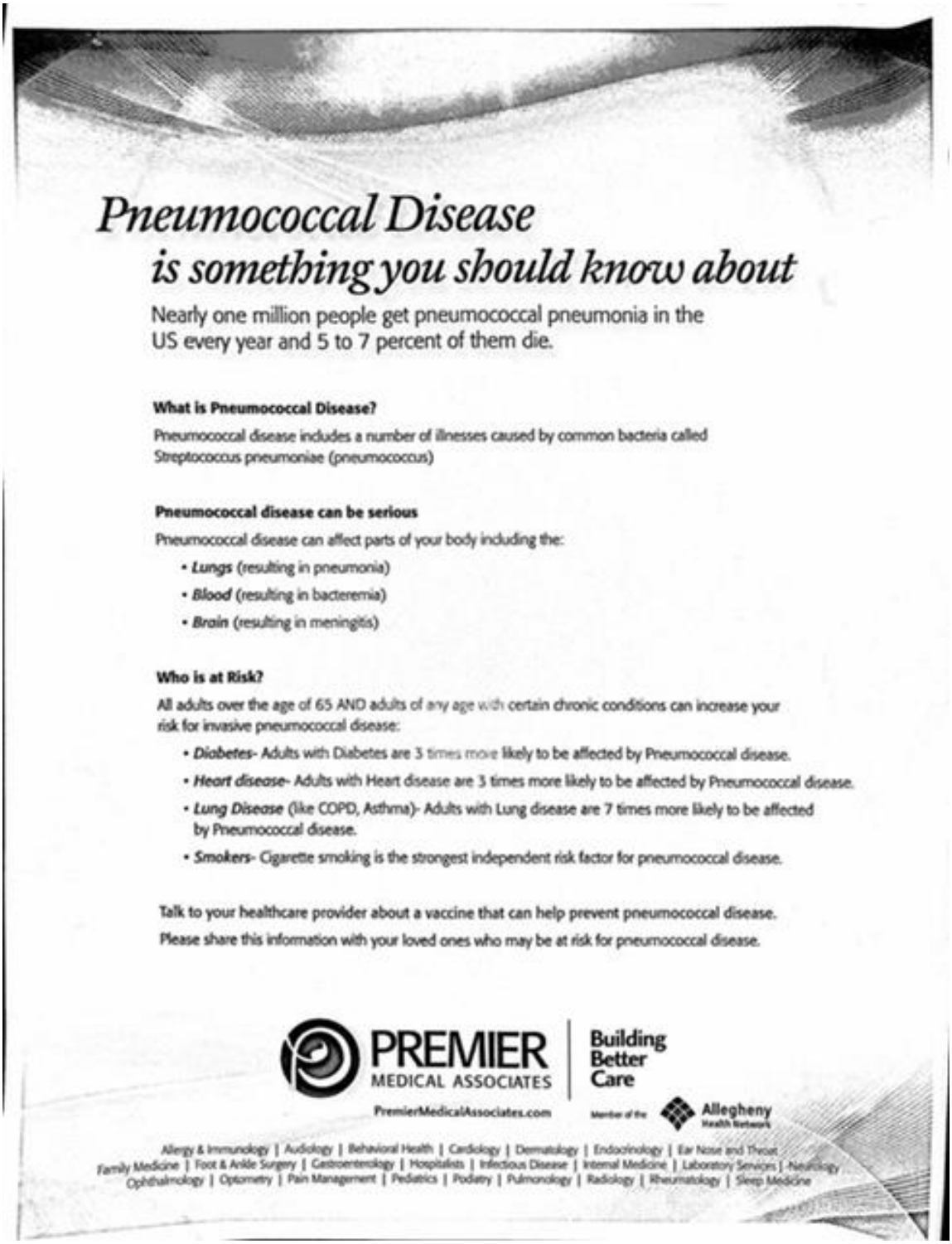
	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

I don't get sick much so there is no reason to get the flu shot. *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

If I get the flu shot, I can not get the flu. *

Appendix D Patient Education - Pneumococcal Disease



Pneumococcal Disease is something you should know about

Nearly one million people get pneumococcal pneumonia in the US every year and 5 to 7 percent of them die.

What is Pneumococcal Disease?

Pneumococcal disease includes a number of illnesses caused by common bacteria called Streptococcus pneumoniae (pneumococcus)

Pneumococcal disease can be serious

Pneumococcal disease can affect parts of your body including the:

- ***Lungs*** (resulting in pneumonia)
- ***Blood*** (resulting in bacteremia)
- ***Brain*** (resulting in meningitis)

Who is at Risk?

All adults over the age of 65 AND adults of any age with certain chronic conditions can increase your risk for invasive pneumococcal disease:

- ***Diabetes***- Adults with Diabetes are 3 times more likely to be affected by Pneumococcal disease.
- ***Heart disease***- Adults with Heart disease are 3 times more likely to be affected by Pneumococcal disease.
- ***Lung Disease*** (like COPD, Asthma)- Adults with Lung disease are 7 times more likely to be affected by Pneumococcal disease.
- ***Smokers***- Cigarette smoking is the strongest independent risk factor for pneumococcal disease.

Talk to your healthcare provider about a vaccine that can help prevent pneumococcal disease.

Please share this information with your loved ones who may be at risk for pneumococcal disease.

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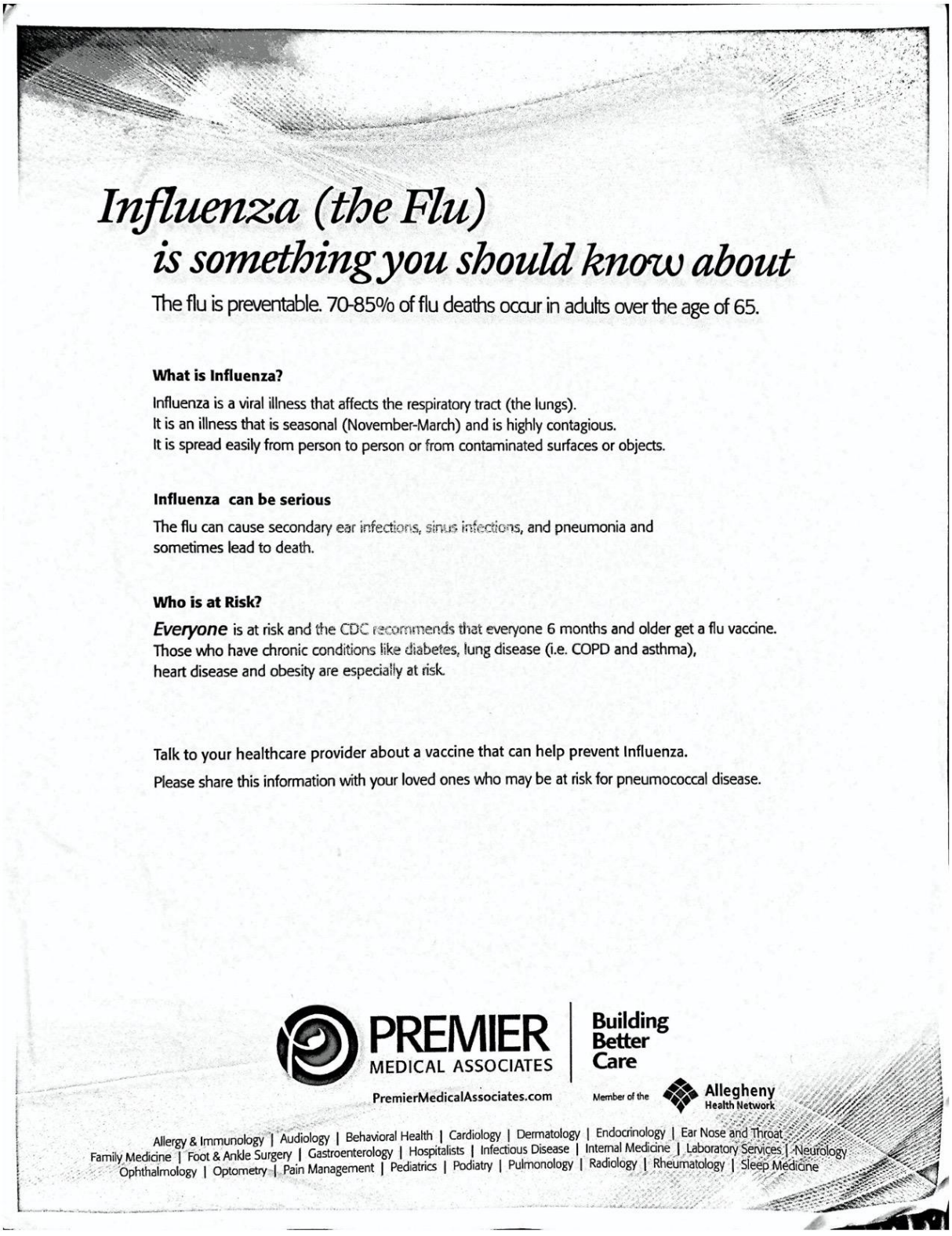
Allergy & Immunology | Audiology | Behavioral Health | Cardiology | Dermatology | Endocrinology | Ear Nose and Throat
Family Medicine | Foot & Ankle Surgery | Gastroenterology | Hospitalists | Infectious Disease | Internal Medicine | Laboratory Services | Neurology
Ophthalmology | Optometry | Pain Management | Pediatrics | Podiatry | Pulmonology | Radiology | Rheumatology | Sleep Medicine

Appendix E Patient Education - Influenza



Influenza (the Flu) is something you should know about

The flu is preventable. 70-85% of flu deaths occur in adults over the age of 65.

What is Influenza?

Influenza is a viral illness that affects the respiratory tract (the lungs).
It is an illness that is seasonal (November-March) and is highly contagious.
It is spread easily from person to person or from contaminated surfaces or objects.

Influenza can be serious

The flu can cause secondary ear infections, sinus infections, and pneumonia and sometimes lead to death.

Who is at Risk?

Everyone is at risk and the CDC recommends that everyone 6 months and older get a flu vaccine. Those who have chronic conditions like diabetes, lung disease (i.e. COPD and asthma), heart disease and obesity are especially at risk.

Talk to your healthcare provider about a vaccine that can help prevent Influenza.

Please share this information with your loved ones who may be at risk for pneumococcal disease.

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Allergy & Immunology | Audiology | Behavioral Health | Cardiology | Dermatology | Endocrinology | Ear Nose and Throat
Family Medicine | Foot & Ankle Surgery | Gastroenterology | Hospitalists | Infectious Disease | Internal Medicine | Laboratory Services | Neurology
Ophthalmology | Optometry | Pain Management | Pediatrics | Podiatry | Pulmonology | Radiology | Rheumatology | Sleep Medicine

Appendix F Electronic Portal Statements

Portal Statement for Pneumococcus

Pneumococcal disease comes from bacteria called Pneumococcus. It is a big cause of pneumonia, blood infections and meningitis. These infections are more likely as you age. Your risk for these illnesses also increases if you have heart disease, diabetes or lung disease. There's good news; you can be vaccinated to be protected against this very serious and potentially life-threatening illness. Please call us to make an appointment for the vaccine. You may know of a loved one that may need this protection. Please share this information with them. If you have already received this vaccine somewhere else, then contact us to update your records. Be well!

Portal Statement for Influenza

Influenza is a highly contagious respiratory illness. It can cause mild to severe illness that can lead to hospitalization or death. Those with chronic medical condition such as diabetes, asthma, heart disease or pregnancy may have serious illness if they contract the flu. The best way to prevent this is by getting a flu shot. The CDC recommends this vaccine for 6 months and older yearly to reduce your chances of getting sick. It's important to vaccinate yourself if you have close contact with loved ones that may have a weakening immune system or unable to get a vaccine for themselves. Please call us to make an appointment for the vaccine. If you have received this vaccine somewhere else, then contact us to update your records. Be well!

Appendix G High Risk/At Conditions for Pneumococcal Illness

High Risk Conditions for Pneumococcal Vaccination

- Sickle Cell disease/other hemoglobinopathy
- Congenital or acquired asplenia
- Congenital or acquired immunodeficiency
- HIV infection
- Chronic renal failure
- Nephrotic syndrome
- Leukemia
- Lymphoma
- Hodgkin's disease
- Generalized Malignancy
- Iatrogenic immunosuppression
- Solid organ transplant
- Multiple myeloma

At-Risk Conditions for Pneumococcal Vaccination

- Chronic heart disease
- Chronic lung disease
- Diabetes mellitus
- Alcoholism
- Chronic liver disease, cirrhosis
- Cigarette smoking

Definitions

ACIP: Advisory Committee on Immunization Practices
AI Collaborative: AMGA's Adult Immunization Best Practices Collaborative
AMGA: American Medical Group Associations
APP: Advanced practice provider
CDC: Centers for Disease Control and Prevention
EHR: Electronic health record
FLU: influenza
HP2020: Healthy People 2020
PCV: Pneumococcal conjugate vaccine
PMA: Premier Medical Associates
PPSV: Pneumococcal polysaccharide vaccine
SOP: Standing order protocol

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